**Claims:**

1. A process to polymerize olefins comprising contacting olefins with a catalyst system comprising an activator and a catalyst precursor represented by the formula:

$$CpD^a(JY)\,(Q)_{(a-2)},$$

wherein:

**Cp** is a substituted or unsubstituted cycloalkadienyl group or related cycloalkadienyl cogener,

each **Q** is independently an anionic leaving group,

**J** is a group 15, 16 or 17 atom;

**a** is the oxidation state of D,

**D** is a group 4, 5 or 6 metal, provided however that when Cp is a mono-cyclic cyclopentadienyl group M is not titanium, and

**Y** is a heteroatom, a substituted heteroatom or a $C_1$ to $C_{100}$ hydrocarbyl group which may optionally contain one or more heteroatoms.

2. The process of claim 1 wherein Cp is a cyclopentadienyl group.

3. The process of claim 1 wherein Cp is an indenyl or fluorenyl group.

4. The process of claim 1 wherein Cp is substituted.

5. The process of claim 3 wherein the indene or fluorene is substituted.

6. The process of claim 1 wherein D is a group four metal.

7. The process of claim 1 wherein D is zirconium or hafnium.

8. The process of claim 2 wherein D is zirconium.

9. The process of claim 1 wherein Y is a substituted or unsubstituted group 13-17 heteroatom or a $C_1$ to $C_{40}$ alkyl, alknyl, aryl, or arylalkyl group.

10. The process of claim 1 wherein Y is an alkyl group, a perfluoroalkyl group, a cycloalkyl group or an aryl group.

11. The process of claim 1 wherein Y is selected from the group consisting of n-propyl, isopropyl, n-butyl, t-butyl, methylcyclohexyl, methylcyclopentyl, methoxymethyl, ethoxymethyl, aminomethyl, aminoethyl, perfluoropropyl,and perfluorobutyl, cyclopentyl, cychexyl, bicyclo[2.2.1]heptyl, phenyl, methyl phenyl, di methyl phenyl, di n-butylphenyl, di-t-butylphenyl, mesityl, 4-trimethylsilyl, fluorophenyl, perfluorophenyl, methoxyphenyl, dimethylaminophenyl, naphthyl, and anthracenyl.

12. The process of claim 1 wherein J is nitrogen, oxygen, sulfur, phosphorus, chlorine, fluorine or bromine.

13. The process of claim 1 wherein J is oxygen, nitrogen or sulfur.

14. The process of claim 1 wherein J is oxygen.

15. The process of claim 1 wherein Cp is an indenyl group, J is oxygen and Y is a substituted or unsubstituted phenyl group.

16. The process of claim 1 wherein the process occurs in the gas phase.

17. The process of claim 1 wherein the process occurs in the slurry phase.

18. A composition comprising an activator and a catalyst precursor represented by the formula:

$$CpD^a(JY)(Q)_{(a-2)},$$

wherein:

**Cp** is a substituted or unsubstituted cycloalkadienyl group or related cycloalkadienyl cogener,

each **Q** is independently an anionic leaving group,

**J** is a group 15, 16 or 17 atom;

**a** is the oxidation state of D,

**D** is a group 4, 5 or 6 metal, provided however that when Cp is a mono-cyclic cyclopentadienyl group M is not titanium, and

**Y** is a heteroatom, a substituted heteroatom or a $C_1$ to $C_{100}$ hydrocarbyl group which may optionally contain one or more heteroatoms.

19. The composition of claim 18 wherein Cp is a cyclopentadienyl group.

20. The composition of claim 18 wherein Cp is an indenyl or fluorenyl group.

21. The composition of claim 18 wherein Cp is substituted.

22. The composition of claim 20 wherein the indene or fluorene is substituted.

23. The composition of claim 18 wherein D is a group four metal.

24. The composition of claim 18 wherein D is zirconium or hafnium.

25. The composition of claim 19 wherein D is zirconium.

26. The composition of claim 18 wherein Y is a substituted or unsubstituted group 13-17 heteroatom or a $C_1$ to $C_{40}$ alkyl, alknyl, aryl, or arylalkyl group.

27. The composition of claim 19 wherein Y is an alkyl group, a perfluoroalkyl group, a cycloalkyl group or an aryl group.

28. The composition of claim 19 wherein Y is selected from the group consisting of n-propyl, isopropyl, n-butyl, t-butyl, methylcyclohexyl, methylcyclopentyl, methoxymethyl, ethoxymethyl, aminomethyl, aminoethyl, perfluoropropyl,and perfluorobutyl, cyclopentyl, cychexyl, bicyclo[2.2.1]heptyl, phenyl, methyl phenyl, di methyl phenyl, di n-butylphenyl, di-t-butylphenyl, mesityl, 4-trimethylsilyl, fluorophenyl, perfluorophenyl, methoxyphenyl, dimethylaminophenyl, naphthyl, and anthracenyl.

29. The composition of claim 18 wherein J is nitrogen, oxygen, sulfur, phosphorus, chlorine, fluorine or bromine,

30. The composition of claim 18 wherein J is oxygen, nitrogen or sulfur.

31. The composition of claim 18 wherein J is oxygen.

32. The composition of claim 18 wherein Cp is an indenyl group, J is oxygen and Y is a substituted or unsubstituted phenyl group.